

The Listing of Claims

Claim 1. (currently amended) A stabilized polymer composition comprising a polyolefin and an antioxidant composition for improving the long term heat stability of polyolefins, said antioxidant composition comprising:

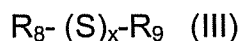
(a) 0.01 – 0.5% by weight of at least one sterically hindered phenolic compound, wherein said phenolic compound contains at least one phenolic moiety of general formula (I):



wherein R₁, R₂, R₃ or R₄ may be the same or different and at least one of R₁, R₂, R₃ or R₄ is selected from the group consisting of branched alkyl having 1 to 12 carbon atoms, the others of R₁, R₂, R₃ or R₄ being H or lower alkyl having 1 to 6 carbon atoms;

(b) 0.01 – 0.5% by weight of at least one phosphorous compound, wherein said phosphorous compound is selected from the group consisting of Tetrakis-(2,4-di-t-butylphenyl)-4,4'-biphenylen-di-phosphonite; Bis(2,6-di-t-butyl-4-methylphenyl)pentaerythrityl-di-phosphite; ~~Di-stearyl-pentaerythrityl-di-phosphite~~; and Bis(2,4-dicumylphenyl)pentaerythritol diphosphite;

(c) 0.01 – 1.0% by weight of at least one sulphur containing compound of general formula (III):



wherein $x = 1$ or 2 , and wherein R_8 and R_9 may be the same or different and are selected from the group consisting of C_{10} - C_{25} alkyl groups, wherein said % by weight values are referred to the polymer composition.

Claim 2. (previously presented) A stabilized polymer composition according to claim 1, comprising a polyolefin and an antioxidant composition, wherein said antioxidant composition comprises:

- (a) 0.02% - 0.2% by weight of said at least one sterically hindered phenolic compound,
 - (b) 0.03% - 0.2% by weight of said at least one phosphorous compound, and
 - (c) 0.05% - 0.6% by weight of said at least one sulphur containing compound of general formula (III),
- wherein said % by weight values are referred to the polymer composition.

Claim 3. (previously presented) A stabilized polymer composition according to claim 1, comprising a polyolefin and an antioxidant composition, wherein said antioxidant composition comprises:

- (a) 0.03% - 0.15% by weight of said at least one sterically hindered phenolic compound;

(b) 0.05% - 0.15% by weight of said at least one phosphorous compound, and

(c) 0.1% - 0.5% by weight of said at least one sulphur containing compound of general formula (III),

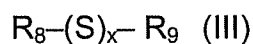
wherein said % by weight values are referred to the polymer composition.

Claim 4. (previously presented) The stabilized polymer composition of claim 1, wherein the phenolic compound contains at least one phenolic moiety of general formula (Ia):



wherein R₁ and R₄ being in the 2- and 6-position of the phenol residue may be the same or different and are selected from the group consisting of branched C₁ to C₁₂ alkyl, R₂ and R₃ having the meaning as given before, and W is selected from C₁ to C₁₂ alkyl, C₁ to C₁₂ alkoxy, C₁ to C₁₂ alkyl carboxylate or C₁ to C₁₂ alkyl substituted by another group of the formula HO-(R₁R₂R₃R₄Phenyl)-, wherein R₁ to R₄ have the meaning as indicated before.

Claim 5. (previously presented) The stabilized polymer composition of claim 1, wherein the sulphur-containing compound of general formula (III):



is selected from Di(C₁-C₂₀)alkyl-(S)_x-di-carboxylate wherein the carboxylic acid is selected from C₁ to C₁₂ alkyl carboxylic acids.

Claim 6. (previously presented) The stabilized polymer composition of claim 1, wherein the sterically hindered phenolic compound is selected from the group consisting of 2,6-Di-tert-butyl-4-methyl phenol; Pentaerythrityl-tetrakis(3-(3',5'-di-tert-butyl-4-hydroxyphenyl)-propionate; Octadecyl 3-(3',5'-di-tert-butyl-4-hydroxyphenyl)propionate; 1,3,5-Trimethyl-2,4,6-tris-(3,5-di-tert-butyl-4-hydroxyphenyl) benzene; 2,2'-Thiodiethylene-bis-(3,5-di-tert-butyl-4-hydroxyphenyl)-propionate; Calcium-(3,5-di-tert-butyl-4-hydroxy benzyl monoethylphosphonate); 1,3,5-Tris(3',5'-di-tert-butyl-4'-hydroxybenzyl)isocyanurate; Bis-(3,3-bis-(4'-hydroxy-3'-tert-butylphenyl) butanoic acid)-glycolester; 4,4'-Thiobis (2-tert-butyl-5-methylphenol); 2,2'-Methylene-bis(6-(1-methyl-cyclohexyl)para-cresol); N,N'-hexamethylene bis(3,5-di-tert Butyl-4-hydroxy hydrocinnamamide; 2,5,7,8-Tetramethyl-2(4',8',12'-trimethyltridecyl) chroman-6-ol; 2,2'-Ethylidenebis(4,6-di-tert-butylphenol); 1,1,3-Tris(2-methyl-4-hydroxy-5-tert-butylphenyl)butane; 1,3,5-Tris(4-tert-butyl-3-hydroxy-2,6-dimethylbenzyl)-1,3,5-triazine-2,4,6-(1H,3H,5H)-trione; 3,9-bis(1,1-dimethyl-2-(beta-(3-tert-butyl-4-hydroxy-5-methylphenyl)propionyloxy)ethyl)-2,4,8,10 -tetraoxaspiro(5,5)undecane; 1,6-Hexanediyl-bis(3,5-bis(1,1-dimethylethyl)-4-hydroxybenzene-propaonate); 2, 6-Di-tert-butyl-4-nonylphenol; 3,5-Di-tert-butyl-4-hydroxyhydrocinnamic acid trimer with 1,3,5-tris (2-hydroxyethyl)-s-triazine-2,4,6(1H,3H,5H)- trione; 4,4'-Butylidenebis(6-tert Butyl-3-methylphenol); 2,2'-Methylene bis (4-methyl-6-tert-butylphenol); 2,2-Bis(4-(2-(3,5-di-t-butyl-4-hydroxyhydrocinnamoyloxy))ethoxyphenyl)) propane; Triethyleneglycol-bis-(3-tert-butyl-4-hydroxy-5 methylphenyl) propionate; Benzenepropanoic acid, 3,5-bis(1,1-

dimethylethyl)-4-hydroxy-, C₁₃-C₁₅-branched and linear alkyl esters; 6,6'-Di-tert-butyl-2,2'-thiodi-p-cresol; Diethyl((3,5-bis(1,1-dimethylethyl)-4-hydroxyphenyl)methyl) phosphonate; 4, 6-Bis (octylthiomethyl) o-cresol; Benzenepropanoic acid, 3,5-bis(1,1-dimethylethyl)-4-hydroxy-, C₇-C₉-branched and linear alkyl esters; 1,1,3-Tris[2-methyl-4-[3-(3,5-di-tert-butyl-4-hydroxyphenyl)propionyloxy]-5-tert-butylphenyl] butane; and Butylated reaction product of p-cresol and dicyclopentadiene.

Claim 7. (previously presented) The stabilized polymer composition of claim 1, wherein the sulphur-containing compound is selected from the group consisting of Di-stearyl-thio-di-propionate; Di-palmityl/stearyl-thio-di-propionate; Di-lauryl-thio-di-propionate; Di-tridecyl-thio-di-propionate; Di-myristyl-thio-di-propionate; Pentaerythritol octyl thiodipropionate; Lauryl-stearyl-thio-di-propionate; Di-octadecyl-disulphide; Di-tert-dodecyl-disulphide and Pentaerythritol-tetrakis-(3-laurylthiopropionate).

Claim 8. (previously presented) The stabilized polymer composition of claim 1, wherein the sterically hindered phenolic compound is selected from the group consisting of Pentaerythrityl-tetrakis(3-(3',5'-di-tert-butyl-4-hydroxyphenyl)-propionate; Octadecyl 3-(3',5'-di-tert-butyl-4-hydroxyphenyl)propionate; 1,3,5-Trimethyl-2,4,6-tris-(3,5-di-tert-butyl-4-hydroxyphenyl) benzene; 1,3,5-Tris(3',5'-di-tert-butyl-4'-hydroxybenzyl)isocyanurate; Bis-(3,3-bis-(4'-hydroxy-3'-tert-butylphenyl)butanoic acid)-glycolester; and 3,9-Bis(1,1-dimethyl-2-(beta-(3-tert-

butyl-4-hydroxy-5-methylphenyl)propionyloxy)ethyl)-2,4,8,10-tetraoxaspiro (5, 5) undecane.

Claim 9. (previously presented) The stabilized polymer composition of claim 1, wherein the sulphur-containing compound is Di-stearyl-thio-di-propionate or Di-tert-dodecyl-disulphide.

Claim 10. (previously presented) The stabilized polymer composition of claim 1, wherein

- (a) the sterically hindered phenolic compound is 1,3,5 Tris (4-tert-butyl-3-hydroxy-2,6-dimethylbenzyl)-1,3,5triazine-2,4,6-(1H,3H,5H)-trione or pentaerythrityltetrakis(3-(3',5'-di-tert-butyl-4-hydroxyphenyl)-propionate;
- (b) the phosphite compound is bis(2,4-dicumylphenyl) pentaerythritol diphosphite; and
- (c) the sulphur-containing compound is Di-stearyl-thio-di-propionate.

Claim 11. (previously presented) The stabilized polymer composition of claim 1, wherein said composition further comprises metal deactivators and/or UV-stabilizers.

Claim 12. (original) The stabilized polymer composition of claim 11, wherein said UV-stabilizers are sterically hindered amines.

Claim 13. (previously presented) The stabilized polymer composition of claim 1, wherein said polyolefin is a homo- or copolymer of polyethylene, polypropylene and polybutadiene.

Claim 14. (Currently Amended) ~~Use of the antioxidant composition as defined in claim 1~~ A method for reducing degradation of a polyolefin material during processing and end use of said polyolefin material, the method comprising mixing the antioxidant composition of claim 1 with said polyolefin material.

Claim 15. (Currently Amended) The use method of claim 14, wherein the long term thermal stability of the polyolefin material is increased.

Claim 16. (previously presented) Method for producing a polyolefin article having an improved long term thermal stability against ageing by radical degradation processes comprising the steps of:

- (a) providing an unstabilized base polyolefin material;
- (b) adding to said base polyolefin material the antioxidant composition as defined in claim 1;
- (c) converting the composition obtained in step (b) in a melt-forming process;
- and
- (d) confectioning the polyolefin material obtained in step (c).

Claim 17. (previously presented) The method of claim 16 further comprising adding other stabilizers and/or modifiers before the converting step c).

Claim 18. (previously presented) The method of claim 16, wherein the converting step c) includes injection molding, blow-molding, rotational molding and extrusion.

Claim 19. (previously presented) The method of claim 16, wherein the confectioning step d) includes cutting, lamination and/or welding.

Claim 20. (previously presented) Polyolefin article having an increased long term ageing stability obtained by the method of claim 16.

Claim 21. (previously presented) The stabilized polymer composition of claim 1, wherein the branched alkyl having 1 to 12 carbon atoms is selected from tert-butyl, iso-propyl, cyclohexyl, cyclopentyl, and adamantyl.

Claim 22. (previously presented) The stabilized polymer composition of claim 1, wherein R₈ and R₉ are optionally substituted with C₁ – C₁₂ alkyl ester carboxylates.

Claim 23. (previously presented) The stabilized polymer composition of claim 4, wherein the branched alkyl having 1 to 12 carbon atoms is selected from tert-butyl, iso-propyl, cyclohexyl, cyclopentyl, and adamantyl.

Claim 24. (previously presented) The method of claim 17, wherein the converting step c) includes injection molding, blow-molding, rotational molding and extrusion.

Claim 25. (previously presented) The method of claim 17, wherein the confectioning step d) includes cutting, lamination and/or welding.

Claim 26. (previously presented) The method of claim 18, wherein the confectioning step d) includes cutting, lamination and/or welding.

Claim 27. (previously presented) Polyolefin article having an increased long term ageing stability obtained by the method of claim 17.

Claim 28. (previously presented) Polyolefin article having an increased long term ageing stability obtained by the method of claim 18.

Claim 29. (previously presented) Polyolefin article having an increased long term ageing stability obtained by the method of claim 19.